Space Weather Technical Forecast

Issued on Friday, 19 January 2024 at 01:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Daily Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity measured by GOES16 was Low over the last 24 hours. Occasional low to mid-ranking C-class flares were observed, peaking with a C5.4 at 18/0408UTC from AR3553, a Cai/Beta just east of centre-disc.

There are currently eight sunspot regions on the disc. They are all magnetically simple, small to moderately sized and most are either stable or weakly decaying. The exception is AR3555 which has shown a slight increase in spot number and size, but despite this the region did not produce any significant flaring.

Some weak Coronal Mass Ejections (CME's) were visible on Lasco C2 imagery over the past 24 hours, none of these are thought to bear Earth-directed components.

Solar Wind / Geomagnetic Activity: Solar winds, as observed at L1 by ACE and DSCOVR, started at Background levels, but after 18/0300UTC a gradual increase occurred with the solar wind reaching slightly elevated levels in the evening, peaking at 490 km/s at 18/1820 UTC. This was possibly due to a weak connection to a coronal hole feature, perhaps from CH92. The IMF was predominantly weak, but did briefly reach moderate levels, peaking at 9 nT at 18/2115 UTC. The north-south component varying between +4 and -6nT. The solar wind density was within single figures ppcc throughout. The phi angle was predominantly positive, with brief fluctuations to become negative.

Geomagnetic activity was Quiet (Kp 0-2) until the evening and then increased slightly to become Unsettled (Kp 3).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at Background levels.

GOES16 high energy (greater than 2MeV) electron flux was predominantly at Normal Background levels. The associated 24-hour fluence was well below Active (1e8 integrated pfu) on a steady trend. The 19/0001UTC 24-hour integrated fluence observation was 1.13e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is expected to continue, with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: No CMEs feature in the forecast. The current slightly elevated solar wind speeds are likely to persist through today, and perhaps tomorrow (20th).

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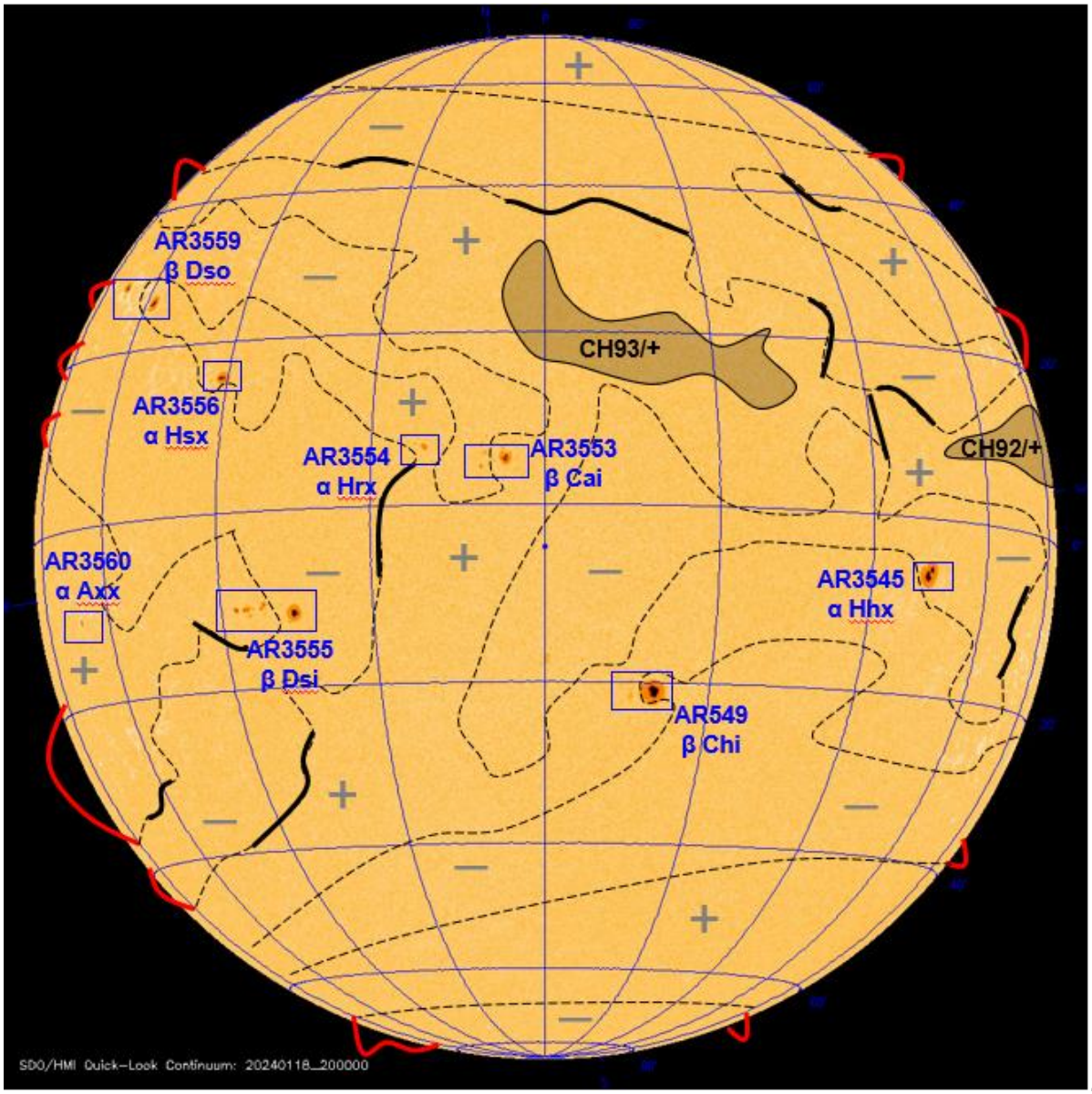
Then a new coronal hole enhancement is expected to arrive late tomorrow from CH93/+, persisting through day 3 (21st) and then declining through day 4 (22nd). Overall geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3), with a chance of Active (Kp 4) intervals today and tomorrow, and a slight chance of Minor Geomagnetic Storm/G1 (Kp 5) tomorrow.

Energetic Particles / Solar Radiation: High energy proton flux is forecast to remain at Background levels, with a daily Slight Chance of radiation storms occurring.
The high energy electron flux is likely to be at predominantly Normal Background levels at first, then rising late in the period. Despite an expected gradually increasing trend the associated fluence is expected to remain below the Active (1e8 integrated flux) threshold throughout.

Figure 1. Solar Analysis Valid 18/2000 UCT.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The current slightly elevated solar wind speeds are probably the result of a late connection to CH92, which is now on the western limb, and is likely to persist through today, and perhaps tomorrow (20th). Then a new coronal hole high speed stream is expected to arrive late tomorrow from CH93, persisting through day 3 (21st) and then declining through day 4 (22nd). This coronal hole is positive polarity, which is becoming less favoured for geomagnetic response at this time of year. Overall geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3), with a chance of Active (Kp 4) intervals today and tomorrow, and a slight chance of Minor Geomagnetic Storm/G1 (Kp 5) tomorrow.

MOSWOC Enlil is suggesting a general increase in wind speeds through this period up to 500-550 km/s, with a possible decline through day 4 (22nd). This trend is considered good guidance, although the wind speeds may be slightly lower than shown by Enlil, especially today.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest SDO/AIA 211 image showing coronal hole 93.

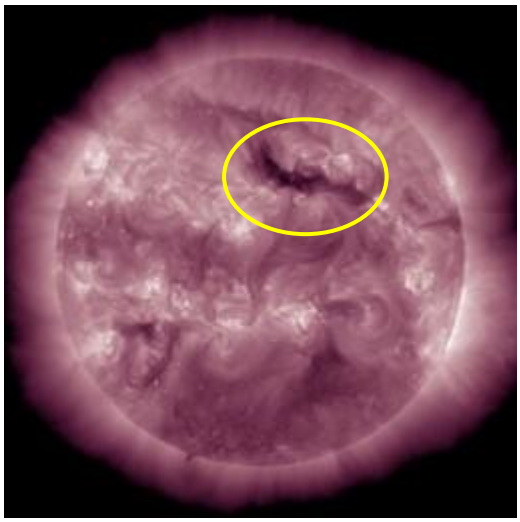

Figure 3: MOSWOC Enlil.

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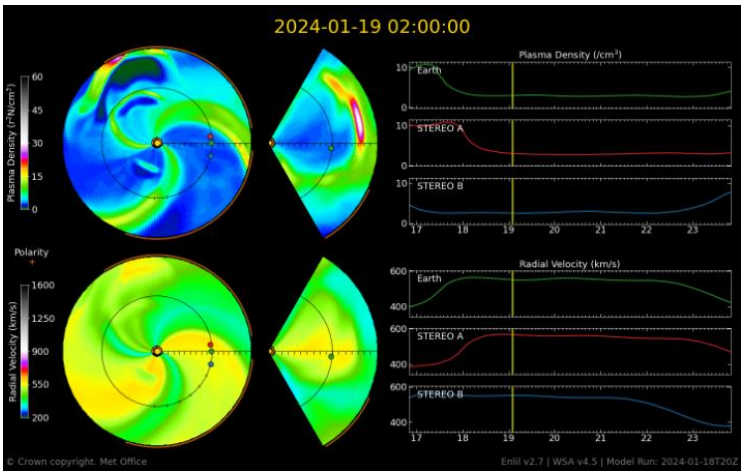
Met Office Space Weather Technical Forecast



Radio Blackouts - X-Ray Flares:

There are currently eight sunspot regions on the disc. The main recent changes have been the development of intermediate spots within AR3555 such that is now assessed as a Dsi/Beta. The tenuous Mt Wilson delta spot in AR3553 has now faded, with the penumbrae surrounding the trailers breaking apart and fading. AR3545 showed an areal decrease and the fading of minor spots surrounding the main penumbra, while AR3549 near south-centre disc showed a minor reconfiguration of its diffuse small trailing spots. All regions are magnetically simple, small to moderately sized and most are either stable or weakly decaying. The exception is AR3355 which has shown a slight increase in spot number and area of penumbra around the intermediate spots, but despite this the region did not produce any significant flaring.
No significant returning regions are due from expected returning Carrington locations in the four days, with the possible sole exception of Ex-3534 in the southern solar hemisphere over the coming UTC weekend. None of the more significant front-sided groups leave in the same interval, although AR3545, an Hhx should lie on the limb on Sunday 21 January. These factors therefore lend themselves to a roughly level tendency for significant flares when considered as a whole.
Low activity is expected to continue, with a chance of isolated M-class flares, these most likely from AR3353 and AR3555.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

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GOES18 high energy (greater than 10MeV) proton flux is currently at Background levels and expected to remain so through the period, with no complex sunspots currently in favourably-connecting parts of the disc, and no recent significant flares.

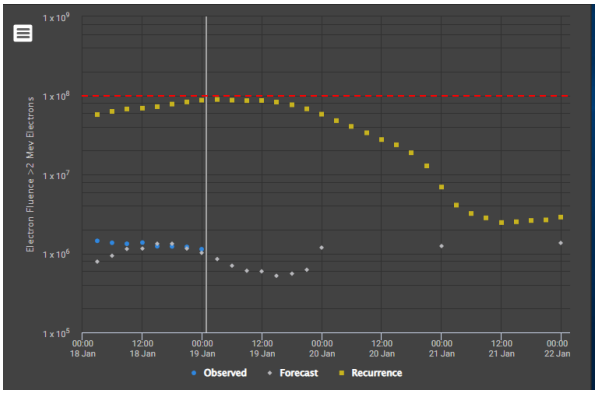
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux is likely to be at predominantly Normal Background levels at first, then gradually rising through the period under the combined influence of the high speed streams from CH92 and CH93. Despite an expected gradually increasing trend the associated fluence is expected to remain below the Active (1e8 integrated flux) threshold throughout.
The Met Office REFM is therefore considered to be offering good guidance for the next three days, keeping the fluence well below the Active level. However, a gradually increasing trend is preferred to the largely flat trend depicted by the model, and this is reflected in the issued probabilities.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM model.



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